



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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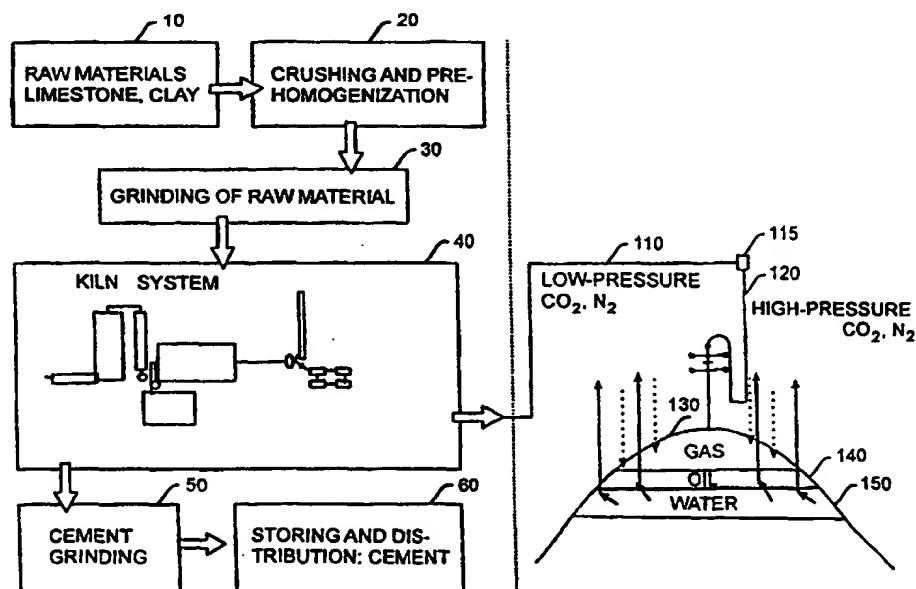
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## Published

With international search report.

(54) Title: RECOVERY OF HYDROCARBONS IN OIL WELLS BY INJECTION OF TREATED INERT GASES OBTAINED FROM THE INDUSTRIAL EFFLUENCE



## (57) Abstract

The invention describes improvements in the process of recovering hydrocarbons in oil wells by injection of treated inert gases of one or various industrial effluences comprising the steps of treating the industrial effluence(s) such as those from cement clinker production by operations appropriate to make the constituents and the parameters of the effluence compatible with the hydrocarbons of the deposit and regulating the distribution of different types of gases from their place of origin.

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RECOVERY OF HYDROCARBONS IN OIL WELLS BY INJECTION OF TREATED INERT GASES OBTAINED FROM THE INDUSTRIAL EFFLUENCE

5 Field of the invention

The present invention relates to improvements in the process of recovering hydrocarbons in oil wells by injection of treated inert gases obtained from industrial effluence.  
10 Particularly it refers to a process of recovering hydrocarbons in oil wells by injection of treated inert gases obtained from the process of cement clinker production.

Preceding of the invention

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Fossil fuels have successfully been burned in furnaces for a long time. Nevertheless, the possible reduction or minimization of air contamination is more and more being emphasized recently. In this aspect it is known that there is  
20 environmental contamination due to toxic substances. Environmental contamination also arises from substances or materials that contribute to the global warming, such as CO<sub>2</sub> for example.

25 Oil well production is classified in free-flowing and artificial production. With the first, hydrocarbons gush to the outside by natural energy, which can be hydraulic pressure or the inherent gas pressure of the deposit. Artificial oil well production or oil well production by pumping is an  
30 exploitation system applied, if the inherent pressure of the deposit is not sufficient for the oil to flow up to the surface.

In the past, oil wells, which were not flowing by inherent  
35 energy, were abandoned, thus generally recovering 20% of the total reserves. With the perfection of the exploitation methods, however, the recovering of hydrocarbons found in

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these oil deposits was increased. Actually, if an oil well stops flowing, artificial exploiting methods are applied such as pneumatic, mechanical or hydraulic pumping.

5 Additionally, there exist systems, which improve the recovery by the injection of natural gas, nitrogen, carbon dioxide or water into the deposit. These systems proved to considerably increase the recovery of hydrocarbons at the deposits, making said recovering process more efficient, additionally  
10 increasing the production capacity of the deposits and allowing a reasonable exploitation of the oil resources. On the other hand, the costs for production and preparation of said gases are rather considerable.

15 Prior Art and cross reference to related applications

Hydrocarbon recovery by injection of inert gases is already known for exhausted oil wells. The following patents show endeavors for its realization and as a reference their  
20 specifications are incorporated.

U.S.patent 3,873,238 with the tittle "Method and apparatus for flowing crude oil from a well" of Johnnie A. Elfarr, granted on March 25<sup>th</sup>, 1975 relates to a method and apparatus for  
25 flowing crude oil from wells wherein a fluid is injected into the oil bearing earth formation for the purpose of reducing the viscosity of the oil and causing it to migrate under induced formation pressure to one or more production wells.

30 U.S.patent 3,892,270 with the title "Production of hydrocarbons from underground formations" of Robert H. Lindquist, granted on July 1<sup>st</sup>, 1976 relates to a method for recovering hydrocarbons by injecting a mixture of oxidizing gas and steam into a lateral conduit of a hydrocarbon-  
35 containing formation to produce a product gas and, based on values contained in such gas, controlling the reactions between mixtures of oxidizing gas and steam and hydrocarbons

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in the formation to optimize the Kilocalories value (BTU) of the product gas.

5 In U.S.patent 4,267,885 with the title "Method and apparatus for optimizing production in a continuous or intermittent gas-lift well" of Dorsey W. Sanderford, granted on May 1<sup>st</sup>, 1981 the temperature of the fluid is sensed at the wellhead and used to determine the injection parameter values to optimize well production. In one embodiment, a process control unit is  
10 programmed according to the inventive method to interpret the temperature data and to control the gas control valve in order to optimize production.

15 U.S.patent 4,025,235 with the title "System for improving oil well production" of Joseph S. Newbrough, granted on May 24<sup>th</sup>, 1977 relates to a system utilizing intermittent build-up and release of gas pressure in the annulus between the casing and tubing in an oil well with an inert gas interface between the gas and the producing fluid.

20 U.S.patent 4,480,697 with the title "Method and apparatus for converting an oil well to a well with effluent raising by gas lift" of Rene F. Goldaniga, Geard Walter, G. W. Walter, Bernard J. P. Glotin and Daniel Gallois, granted on November  
25 6<sup>th</sup>, 1984 relates to a method of and apparatus for converting an oil well with natural effluent rise to one with gas-lift of the effluent column, wherein the oil well has a nipple in the production tube provided with a stop-groove and smooth bearing surfaces between which a hydraulic control line comes out.

30 U.S.patent 4,649,994 with the title "Installation for bringing hydrocarbon deposits into production with reinjection of effluents into the deposit or into the well or wells" of Gerard Chaudot, granted on March 17<sup>th</sup>, 1987 relates to an  
35 installation for bringing into production hydrocarbon deposits with reinjection of effluents into the deposit or into the well or wells and a process for using this installation. Said

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installation comprises at least one sealed casing, the base of which communicates with the deposit; at least one sealing plug disposed in the lower part of the casing and forming a capacity; at least one duct for either injecting or removing a pressurized gas; a condensate injection pipe passing through the capacity and opening into the base of the casing beyond said plug, this pipe communicating with the inner volume of the casing downstream of the plug, as well as with said capacity through a valve system.

10

U.S.patent 5,105,889 with the title "Method of production of formation fluid and device for effecting thereof" of Taimuraz K. Misikov, Vladimir M. Shaposhnikov and Alexandr P.Skripkin granted on April 21<sup>th</sup>, 1992 relates to a method of production of the formation fluid, which is used in wells with a low formation pressure. The method consists in that the gas is dissolved in the well from a flow of the formation fluid forcedly liberated, whereupon the formation fluid is transformed into a finely dispersed gas-liquid flow in which the amount of liberated gas ensures self-lift of the formation fluid to the wellhead.

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WO98/0233A2 with the title "Fluid separation and reinjection systems for oil wells" of Christopher K.Shaw published on November 7<sup>th</sup>, 1997 relates to a fluid separation and reinjection system for use in a wellbore extending through a production zone producing an oil/water mixture and a water reinjection zone, which comprises a tubing disposed within the wellbore in fluid communication with the production zone defining an oil flow channel and in fluid communication with the water reinjection zone defining a water reinjection channel.

25

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Neither the references cited above nor the literature to the best knowledge of the inventors reveal the possibility of utilizing industrial effluence and in particular inert gases

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from the burning of clinker for the recovery of hydrocarbons from exhausted oil wells.

#### Summary of the invention

5

An object of the present invention is to recover hydrocarbons from exhausted oil wells by treated inert gases, which arise from the effluence (escape or chimney gases) of industrial waste. The inert gases are mostly composed of nitrogen and  
10 carbon dioxide.

Another object of the present invention is to utilize the emission gases of the combustion and calcination in production processes, in particular in the processes of the cement  
15 clinker production.

Another object of the present invention is to utilize emission gases of the combustion of materials such as fossil fuel (oil, gas and coal) or alternative fuels such as waste tires and  
20 waste wood, etc.

Another object of the invention is the reduction of the contamination level of cement clinker production processes.

25 The invention has as additional object the treatment of combustion gases in order to utilize them in other processes in which certain of their components are used.

Another object of the invention is to reduce contamination of  
30 cement clinker production.

#### Description

The present invention relates to improvements in the process  
35 of recovering hydrocarbons in oil wells. The recovering of hydrocarbons is realized by the injection of treated inert

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gases of one or various industrial effluences. Actually, the improvements of the process consist in

- 5       - treating the industrial effluence by operations appropriate to make constituents and parameters such as for example temperature, concentration, pressure and/or expenditure of the industrial effluence compatible with the hydrocarbons of the deposit and
- 10      - regulating the distribution of different types of gases from their place of origin.

15       In one embodiment of the invention the industrial effluences were selected from combustion and/or calcination gases from production processes.

20       Some examples for the operations used for the invention are adsorption, separation of dust, condensation, liquefaction and distillation, compression and distribution. These operations, which are known in detail to those who are skilled in the art, are not described in the present specification for reasons of simplicity.

25       The inert gases according to the invention comprise a mixture of  $N_2$  and  $CO_2$  with a percentage of 75 to 85 and 15 to 25%, such that the sum results in 100%.

30       It has been found that in order to make the constituents compatible it is particularly advantageous to augment the concentration of  $N_2$  in the injection gases taking a part of the air coming from the chimney.

By the present invention it is possible to recycle water and oxygen.

35       Surprisingly it was found that by the present invention the contamination of the cement clinker production was reduced.



Short description of the drawings

A number of objects of the invention have been mentioned above. Other objects and advantages of the invention will  
5 appear according to the progress of the invention by taking into account the following drawings, in which an example of the best way of the invention is illustrated. Taking into account the figures of the drawings

10 Fig.1 is a schematic diagram of the process according to the present invention, which includes both the cement process and the process of the oil deposit and

Fig.2 is a schematic diagram of the conditioning of the  
15 combustion gases in the cement process for the injection into the oil deposit.

Detailed description of the drawings

20 With reference to the figures a first embodiment is shown in Fig.1 and Fig.2. The invention follows the part of the cement process, where as raw materials limestone and clay are fed (10) to a step of crushing and prehomogenization (20) whereupon follows a step of grinding the raw material (30).  
25 The ground raw material is supplied to a kiln system (40), wherefrom it is proceeded on the one hand to cement grinding (50) and thereupon to storage and distribution of the cement (60). On the other hand low-pressure CO<sub>2</sub> and N<sub>2</sub> (110) as effluence pass through a compressor (115) in order to produce  
30 high-pressure CO<sub>2</sub> and N<sub>2</sub> (120) for supplying them to the oil deposit, in which the gas phases (130), oil (140) and water (150) are found.

As is illustrated in Fig.2 the conditioning of the gases in  
35 the cement process comprises in a particular embodiment a step of existing dedusting, a step of additional dust removal, a step of condensation, wherefrom H<sub>2</sub>O, HCl, SO<sub>2</sub> are recycled, a

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step of liquefaction and distillation with CO<sub>2</sub> and O<sub>2</sub>, which can be recycled and a final step of compression and distribution of N<sub>2</sub> and CO<sub>2</sub>. This structure or configuration is preferred for the present application but may not be necessary for other applications.

Description of an example including the best mode of the invention

The demand for inert gases for recovering hydrocarbons in the oil deposits in the region of the south of Mexico is approximately 16 million m<sup>3</sup>/day (564 million cubic feet/day). This volume being required a net of distribution ducts is envisaged from various potential sources in order to inject gases into the oil deposits considering the gas-producing sources near the oil deposits having supplying potential. The potential sources are shown in table 1.

Table 1: Potential sources of gas injection into oil deposit in the Southeast region.

Sources	Inert gas	Ntcfd	Ncmd	%
Apasco, Mucaspansa	CO <sub>2</sub> , N <sub>2</sub>	148 344	4 200 000	26
Campo Carmito	CO <sub>2</sub>	80 000	2 264 000	14
Petroquimicas	CO <sub>2</sub>	100 000	2 830 000	18
Apasco, Orizaba	CO <sub>2</sub> N <sub>2</sub>	235 656	6 669 065	42
Total potential		564 000	15 961 200	100

Ntcfd: Normalized (0°C, 1 atm) thousand cubic feet per day;

Ncmd: Normalized (0°C, 1 atm) cubic meter per day

The table shown above indicates the total distribution of the injection gases required for all oil deposits in the Southeast

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oil exploiting region with the supply of a number of near sources producing inert gases.

5 It should be evident, that the requirements of the inert gases will vary from one oil deposit to another, the parameters like pressure and temperature of the gas supply will have to be considered and that the distribution of the producing sources of different types of gases will be a function of the compatibility of these gases with the hydrocarbons of the  
10 deposit.

A number of details of the invention can be changed without going beyond the scope of the invention. Additionally, the above description of the preferred embodiment of the invention  
15 and the best way for carrying out the invention is proposed merely for the intention of illustration and not for the intention of limitation. The invention is defined only by its claims.

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## Claims:

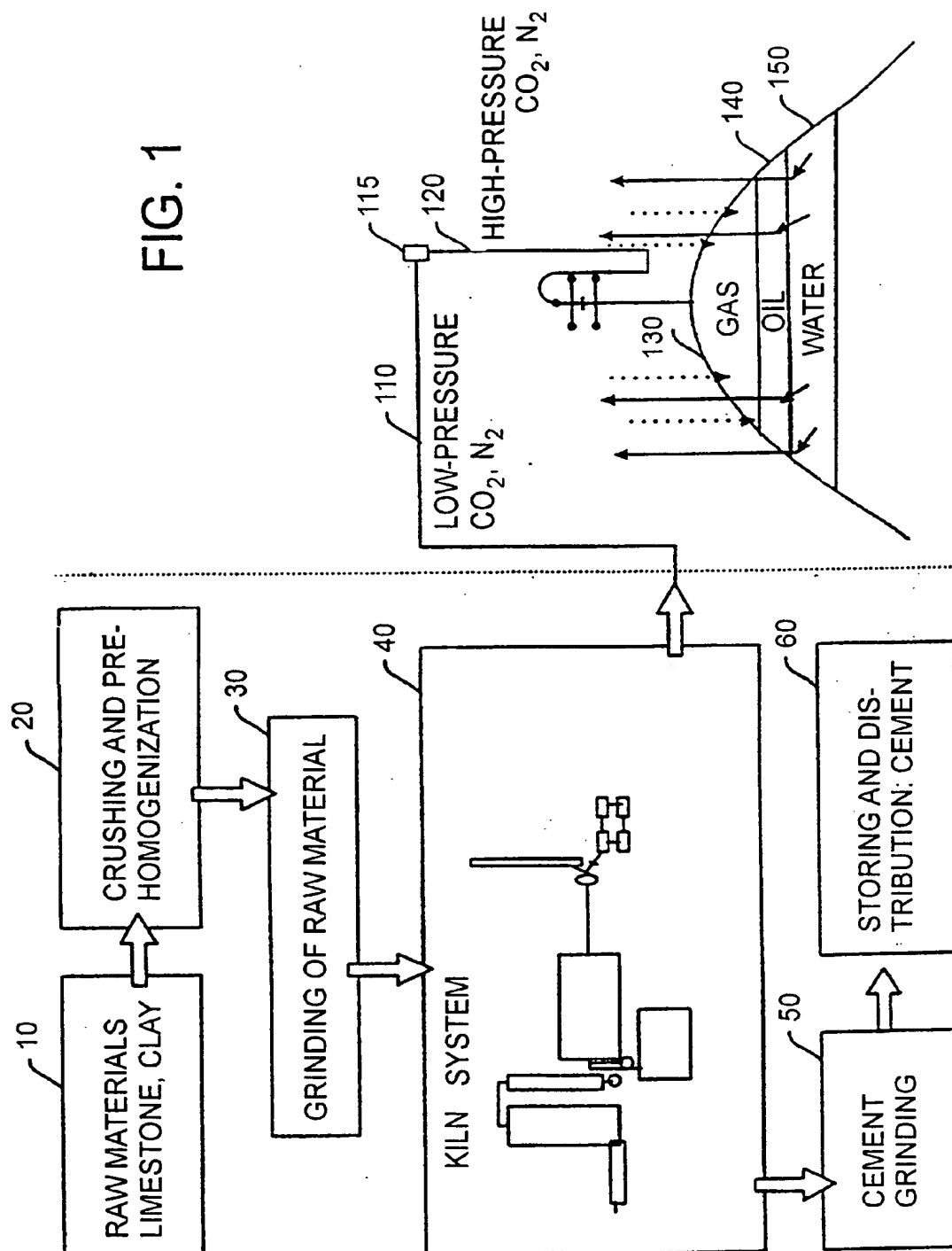
1. Improvements in the process of recovering hydrocarbons in oil wells by injection of treated inert gases of one or various industrial effluences comprising the steps of treating the industrial effluence(s) by operations appropriate to make the constituents and the parameters of the effluence compatible with the hydrocarbons of the deposit and regulating the distribution of different types of gases from their place of origin.
2. Improvements in the process of recovering hydrocarbons in oil wells according to claim 1, characterized in that combustion and/or calcination gases from production processes are selected as industrial effluence.
3. Improvements in the process of recovering hydrocarbons in oil wells according to claim 1 or 2, characterized in that the parameters for making the industrial effluence compatible are temperature, concentration, pressure and expenditure.
4. Improvements in the process of recovering hydrocarbons in oil wells according to any one of claims 1 to 3, characterized in that appropriate operations are applied: adsorption, separation of dusts, condensation, liquefaction, and distillation, compression and distribution.
5. Improvements in the process of recovering hydrocarbons in oil wells according to any one of claims 1 to 4, characterized in that the inert gases comprise a mixture of CO<sub>2</sub> and N<sub>2</sub>.
6. Improvements in the process of recovering hydrocarbons in oil wells according to any one of claims 1 to 5, characterized in that water and oxygen are recycled.
7. Improvements in the process of recovering hydrocarbons in oil wells according to claim 6, characterized in that a

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percentage of N<sub>2</sub> and CO<sub>2</sub> of 75 to 85 and 15 to 25%, respectively, is obtained, such that the sum of both results in 100%.

- 5 8. Improvements in the process of recovering hydrocarbons in oil wells according to any one of claims 1 to 7, characterized in that part of the air coming from the chimney is taken in order to augment the concentration of N<sub>2</sub> of the injection gases.
- 10 9. Improvements in the process of recovering hydrocarbons in oil wells according to any one of claims 1 to 8, characterized in that the emission gases of the combustion of materials selected from the group consisting of fossil fuel (oil, gas
- 15 and coal) or alternative fuels as waste tires and waste wood, etc. and combinations thereof are used.
- 20 10. Method for reducing the contamination in the cement clinker production, characterized in that the effluence coming from combustion and/or calcining gases is treated by appropriate operations in order to make the constituents and their parameters compatible for utilizing them for recovering hydrocarbons in oil wells.

FIG. 1



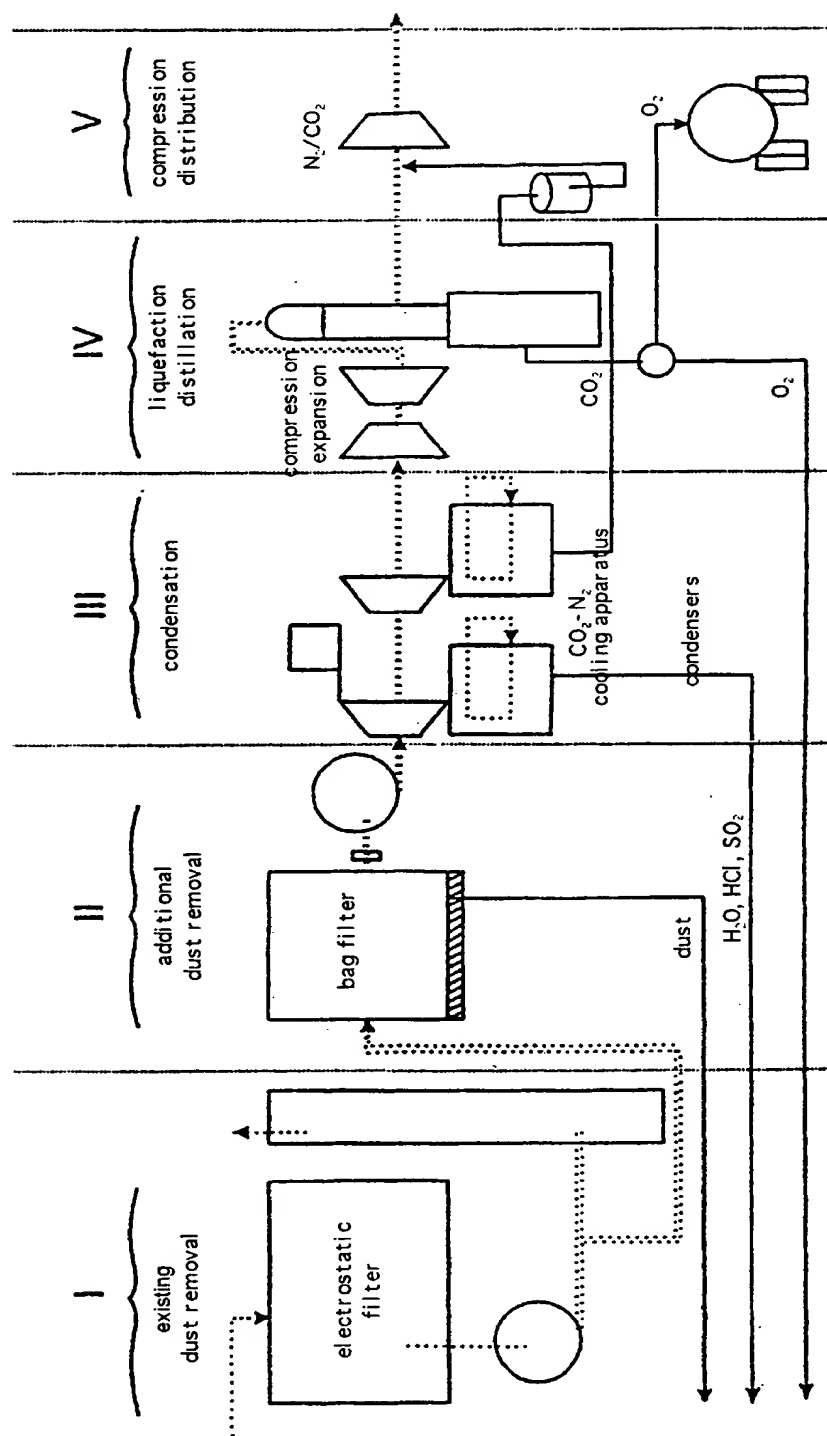


FIG. 2

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 99/01843

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C04B/36 E21B43/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C04B E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 113 017 A (HITZMAN DONALD O) 12 September 1978 (1978-09-12) column 1, line 54 - line 66 ---	1-3,9
A	US 5 439 054 A (VOLZ JR RICHARD F ET AL) 8 August 1995 (1995-08-08) column 1, line 15 - line 24 column 1, line 63 -column 2, line 4 ---	1-10
A	US 4 313 500 A (JOHNSON JR JAMES S ET AL) 2 February 1982 (1982-02-02) column 3, line 18 - line 30 ---	1
A	US 4 713 185 A (HOWARD JOHN ET AL) 15 December 1987 (1987-12-15) column 2, line 51 - line 68 ---	1
	-/--	<i>Considered ok 22/10/03</i>

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

24 January 2000

Date of mailing of the international search report

31/01/2000

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# INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 195 11 304 A (GRAF EPE GMBH) 2 October 1996 (1996-10-02) abstract	10
A	US 5 219 544 A (KUPPER DETLEV ET AL) 15 June 1993 (1993-06-15) abstract	10

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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			ES 2059962 T	16-11-1994

# PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

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International Application No. \_\_\_\_\_

International Filing Date \_\_\_\_\_

Name of receiving Office and "PCT International Application" \_\_\_\_\_

Applicant's or agent's file reference  
(if desired) (12 characters maximum) **36473**

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State (that is, country) of nationality: <b>MX</b>	State (that is, country) of residence: <b>MX</b>
<p><b>This person is applicant for the purposes of:</b></p> <p> <input type="checkbox"/> all designated States                <input type="checkbox"/> all designated States except the United States of America                <input checked="" type="checkbox"/> the United States of America only                <input type="checkbox"/> the States indicated in the Supplemental Box         </p>	

<p><small>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</small></p> <p><b>RODRIQUEZ Heberto Ramos</b>  <b>Nacajuca 118, Col. Prados de Villahermosa</b>  <b>C.P. 86100 Villahermosa</b>  <b>Tabasco</b>  <b>Mexico</b></p>	<p><b>This person is:</b></p> <p><input type="checkbox"/> applicant only</p> <p><input checked="" type="checkbox"/> applicant and inventor</p> <p><input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p>
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State (that is, country) of nationality: <b>MX</b>	State (that is, country) of residence: <b>MX</b>
<p><b>This person is applicant for the purposes of:</b></p> <p> <input type="checkbox"/> all designated States                <input type="checkbox"/> all designated States except the United States of America                <input checked="" type="checkbox"/> the United States of America only                <input type="checkbox"/> the States indicated in the Supplemental Box         </p>	

<p><small>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</small></p>	<p><b>This person is:</b></p> <p><input type="checkbox"/> applicant only</p> <p><input type="checkbox"/> applicant and inventor</p> <p><input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p>
---	--

State (that is, country) of nationality:	State (that is, country) of residence:
<p><b>This person is applicant for the purposes of:</b></p> <p> <input type="checkbox"/> all designated States                <input type="checkbox"/> all designated States except the United States of America                <input type="checkbox"/> the United States of America only                <input type="checkbox"/> the States indicated in the Supplemental Box         </p>	

<p><small>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</small></p>	<p><b>This person is:</b></p> <p><input type="checkbox"/> applicant only</p> <p><input type="checkbox"/> applicant and inventor</p> <p><input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p>
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State (that is, country) of nationality:	State (that is, country) of residence:
<p><b>This person is applicant for the purposes of:</b></p> <p> <input type="checkbox"/> all designated States                <input type="checkbox"/> all designated States except the United States of America                <input type="checkbox"/> the United States of America only                <input type="checkbox"/> the States indicated in the Supplemental Box         </p>	

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No. V DESIGNATION OF STATES	
The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):	
<b>Regional Patent</b>	
<input checked="" type="checkbox"/> AP	ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
<input checked="" type="checkbox"/> EA	Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
<input checked="" type="checkbox"/> EP	European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
<input checked="" type="checkbox"/> OA	OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)
<b>National Patent (if other kind of protection or treatment desired, specify on dotted line):</b>	
<input checked="" type="checkbox"/> AL Albania	<input checked="" type="checkbox"/> LS Lesotho
<input checked="" type="checkbox"/> AM Armenia	<input checked="" type="checkbox"/> LT Lithuania
<input checked="" type="checkbox"/> AT Austria	<input checked="" type="checkbox"/> LU Luxembourg
<input checked="" type="checkbox"/> AU Australia	<input checked="" type="checkbox"/> LV Latvia
<input checked="" type="checkbox"/> AZ Azerbaijan	<input checked="" type="checkbox"/> MD Republic of Moldova
<input checked="" type="checkbox"/> BA Bosnia and Herzegovina	<input checked="" type="checkbox"/> MG Madagascar
<input checked="" type="checkbox"/> BB Barbados	<input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia
<input checked="" type="checkbox"/> BG Bulgaria	<input checked="" type="checkbox"/> MN Mongolia
<input checked="" type="checkbox"/> BR Brazil	<input checked="" type="checkbox"/> MW Malawi
<input checked="" type="checkbox"/> BY Belarus	<input checked="" type="checkbox"/> MX Mexico
<input checked="" type="checkbox"/> CA Canada	<input checked="" type="checkbox"/> NO Norway
<input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein	<input checked="" type="checkbox"/> NZ New Zealand
<input checked="" type="checkbox"/> CN China	<input checked="" type="checkbox"/> PL Poland
<input checked="" type="checkbox"/> CU Cuba	<input checked="" type="checkbox"/> PT Portugal
<input checked="" type="checkbox"/> CZ Czech Republic	<input checked="" type="checkbox"/> RO Romania
<input checked="" type="checkbox"/> DE Germany	<input checked="" type="checkbox"/> RU Russian Federation
<input checked="" type="checkbox"/> DK Denmark	<input checked="" type="checkbox"/> SD Sudan
<input checked="" type="checkbox"/> EE Estonia	<input checked="" type="checkbox"/> SE Sweden
<input checked="" type="checkbox"/> ES Spain	<input checked="" type="checkbox"/> SG Singapore
<input checked="" type="checkbox"/> FI Finland	<input checked="" type="checkbox"/> SI Slovenia
<input checked="" type="checkbox"/> GB United Kingdom	<input checked="" type="checkbox"/> SK Slovakia
<input checked="" type="checkbox"/> GD Grenada	<input checked="" type="checkbox"/> SL Sierra Leone
<input checked="" type="checkbox"/> GE Georgia	<input checked="" type="checkbox"/> TJ Tajikistan
<input checked="" type="checkbox"/> GH Ghana	<input checked="" type="checkbox"/> TM Turkmenistan
<input checked="" type="checkbox"/> GM Gambia	<input checked="" type="checkbox"/> TR Turkey
<input checked="" type="checkbox"/> HR Croatia	<input checked="" type="checkbox"/> TT Trinidad and Tobago
<input checked="" type="checkbox"/> HU Hungary	<input checked="" type="checkbox"/> UA Ukraine
<input checked="" type="checkbox"/> ID Indonesia	<input checked="" type="checkbox"/> UG Uganda
<input checked="" type="checkbox"/> IL Israel	<input checked="" type="checkbox"/> US United States of America
<input checked="" type="checkbox"/> IN India	<input checked="" type="checkbox"/> UZ Uzbekistan
<input checked="" type="checkbox"/> IS Iceland	<input checked="" type="checkbox"/> VN Viet Nam
<input checked="" type="checkbox"/> JP Japan	<input checked="" type="checkbox"/> YU Yugoslavia
<input checked="" type="checkbox"/> KE Kenya	<input checked="" type="checkbox"/> ZW Zimbabwe
<input checked="" type="checkbox"/> KG Kyrgyzstan	
<input checked="" type="checkbox"/> KP Democratic People's Republic of Korea	
<input checked="" type="checkbox"/> KR Republic of Korea	
<input checked="" type="checkbox"/> KZ Kazakhstan	
<input checked="" type="checkbox"/> LC Saint Lucia	<input checked="" type="checkbox"/> AE United Arab Emirates
<input checked="" type="checkbox"/> LK Sri Lanka	<input checked="" type="checkbox"/> ZA South Africa
<input checked="" type="checkbox"/> LR Liberia	<input checked="" type="checkbox"/> TZ United Republic of Tanzania
	<input checked="" type="checkbox"/> CR Costa Rica
	<input checked="" type="checkbox"/> DM Dominica
Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:	
Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)	

<b>Box No. VI PRIORITY CLAIM</b>					<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:			
		national application: country	regional application: regional Office	international application: receiving Office	
item (1) (07.12.98) 07 December 1998	9810320	Mexico			
item (2)					
item (3)					
<input type="checkbox"/> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):					
<small>* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(h)(ii)). See Supplemental Box.</small>					
<b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>					
<b>Choice of International Searching Authority (ISA)</b> <small>(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):</small>		<b>Request to use results of earlier search: reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):</b> Date (day/month/year)      Number      Country (or regional Office)			
ISA / EP					
<b>Box No. VIII CHECK LIST; LANGUAGE OF FILING</b>					
This international application contains the following number of sheets: request : 4 description (excluding sequence listing part) : 9 claims : 2 abstract : 1 drawings : 2 sequence listing part of description : Total number of sheets : 18		This international application is accompanied by the item(s) marked below: 1. <input checked="" type="checkbox"/> fee calculation sheet 2. <input type="checkbox"/> separate signed power of attorney 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input checked="" type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 1 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input type="checkbox"/> other (specify):			
Figure of the drawings which should accompany the abstract:		Language of filing of the international application: english			
<b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>					
<small>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</small>					
Cementos Apasco S.A. de C.V. 					
For receiving Office use only					
1. Date of actual receipt of the purported international application:		2. Drawings: <input type="checkbox"/> received:  <input type="checkbox"/> not received:			
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:					
4. Date of timely receipt of the required corrections under PCT Article 11(2):					
5. International Searching Authority (if two or more are competent): ISA /		6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.			
For International Bureau use only					
Date of receipt of the record copy by the International Bureau:					

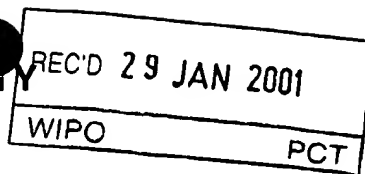
Eduardo Kretschmer  
Vicepresident

Jacques Bourgon  
Vicepresident

Cesar Anatolio Garcia Vidrio

Denzil Cotera Vazquez

Heberto Ramos Rodriguez



## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 36473	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IB99/01843	International filing date (day/month/year) 19/11/1999	Priority date (day/month/year) 07/12/1998
International Patent Classification (IPC) or national classification and IPC C04B7/36		
Applicant CEMENTOS APASCO S.A. DE C.V. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  04/07/2000	Date of completion of this report  25.01.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Fortunati, T  Telephone No. +49 89 2399 8561 

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01843

## I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

### Description, pages:

1-9 as originally filed

### Claims, No.:

1-9 with telefax of 07/12/2000

### Drawings, sheets:

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01843

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.  
☐ paid additional fees.  
☐ paid additional fees under protest.  
☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.  
☒ not complied with for the following reasons:  
**see separate sheet**

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.  
☐ the parts relating to claims Nos. .

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-7,9
	No:	Claims	8
Inventive step (IS)	Yes:	Claims	1-7,9
	No:	Claims	

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01843

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Industrial applicability (IA)    Yes:    Claims    1-9  
   No:    Claims

2. Citations and explanations  
    **see separate sheet**

## **VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/IB99/01843

1) Reference is made to the following documents:

- D1: US-A-4 113 017 (HITZMAN DONALD O) 12 September 1978 (1978-09-12)
- D2: US-A-5 439 054 (VOLZ JR RICHARD F ET AL) 8 August 1995 (1995-08-08)
- D3: US-A-4 313 500 (JOHNSON JR JAMES S ET AL) 2 February 1982 (1982-02-02)
- D4: US-A-4 713 185 (HOWARD JOHN ET AL) 15 December 1987 (1987-12-15)
- D5: DE 195 11 304 A (GRAF EPE GMBH) 2 October 1996 (1996-10-02)
- D6: US-A-5 219 544 (KUPPER DETLEV ET AL) 15 June 1993 (1993-06-15)

2) Regarding section VIII:

- 2.1) The formulation "... compatible for utilizing them for recovering hydrocarbons in oil wells. " ( see claim 8 of the application, the last two lines ) is not clear. This formulation "... compatible for utilizing them for recovering hydrocarbons in oil wells. " is a use-feature and not a process-feature. Claim 8 of the application is a process-claim and not a use-claim. This formulation can be maintained in claim 8. However, it does not limit the scope of protection of claim 8 because claim 8 is a process-claim and not a use-claim. In other words, it is just as if this formulation were not indicated in claim 8. On the contrary, the formulation "... compatible with the hydrocarbons of the deposit and that the treated inert gases are injected into the oil well. " ( see claim 9 of the application, the last three lines ) is expressed as a process-feature. This formulation of claim 9 would be acceptable for claim 8.

3) Regarding section IV:

- 3.1) The present application is not unitary. In fact , process-claim 1 refers to a process for recovering hydrocarbons in oil wells whereas process-claim 8 refers to a process for reducing the contamination in the cement clinker production. It is not evident what is the common inventive concept linking the two claims.

4) Regarding section V:

- 4.1) Claim 1 of the present application is considered as new and inventive with respect to document D1 for the following reasons:

*Considered  
OK  
2/27/03*

The document D1 does not disclose that inert gases are being used for recovering hydrocarbons in oil wells. The document D1 merely describes the use of gases obtained by a partial combustion, which means that these gases are reactive as, e.g., CO. The reactive gases like CO are oxidized to CO<sub>2</sub>, whereby a respective reduction takes place in the oil well. Thus the document D1 does not disclose the use of inert gases nor the use of industrial effluences.

4.2) Independent claim 8 is not considered as new for the following reasons:

Claim 8 is not clear and not unitary for the reasons indicated in sections IV and VIII above. Moreover, claim 8 is not new with respect to document D6. In fact, document D6 describes a process for reducing the contamination in the cement clinker production, such a process based on an adsorption step in order to treat the effluent gases and obtain an inert gas. As indicated in section 2.1) above, the formulation "... compatible for utilizing them for recovering hydrocarbons in oil wells." of claim 8 of the application cannot limit the scope of claim 8 and cannot be used to distinguish claim 8 of the application from the teaching of D6.

4.3) It is not evident why independent process-claim 8 has not been formulated as a claim dependent on claim 1. In fact, the only additional feature of claim 8 with respect to claim 1 resides in the fact that claim 8 further specifies that the effluences come from the combustion and/or calcining gases of the cement clinker production. On the contrary, claim 1 merely refers to " industrial effluences " and does not specify the kind of chemical process, production or plant from which these effluences come. As a consequence, claim 8 could have been formulated as a dependent claim of the following type:

" A process according to claim 1 , characterized in that the industrial effluences are the combustion and/or calcining gases of a cement clinker production ".

4.4) Documents D2 to D5 are background documents and are not considered as relevant.

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C. 20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 11 August 2000 (11.08.00)	
<b>International application No.</b> PCT/IB99/01843	<b>Applicant's or agent's file reference</b> 36473
<b>International filing date</b> (day/month/year) 19 November 1999 (19.11.99)	<b>Priority date</b> (day/month/year) 07 December 1998 (07.12.98)
<b>Applicant</b> VIDRIO, César Anatolio Garcia et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

04 July 2000 (04.07.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Olivia RANAIVOJAONA</p> <p>Telephone No.: (41-22) 338.83.38</p>
--	--

m.H

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>36473</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/IB 99/01843</b>	International filing date (day/month/year) <b>19/11/1999</b>	(Earliest) Priority Date (day/month/year) <b>07/12/1998</b>
Applicant <b>CEMENTOS APASCO S.A. DE C.V. et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

**RECOVERY OF HYDROCARBONS IN OIL WELLS BY INJECTION OF TREATED INERT GASES  
OBTAINED FROM THE INDUSTRIAL EFFLUENCE**

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

national application No.

PCT/IB 99/01843

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

line 4, insert ",such as those from cement clinker production," after  
"effluence(s)"

## Druckexemplar

7. DEZ. 2000 16:36

AUPAT-DR. HAFFNER +43 1 5339250

NR. 894 S. 5

- 1 -

## Claims:

- Sub C3
- 5
- 10
- 15
- 20
- 25
- 30
- 35
1. A process for recovering hydrocarbons in oil wells by injection of treated inert gases characterized in that industrial effluences are subjected to one or more of adsorption, separation of dusts, condensation, liquefaction, distillation and compression and that temperature, concentration, pressure and/or expenditure of the industrial effluences are adjusted in order to obtain treated inert gases compatible with the hydrocarbons of the deposit.
  2. A process according to claim 1, characterized in that combustion and/or calcination gases from production processes are selected as industrial effluence.
  3. A process according to claim 1 or 2, characterized in that the treated inert gases comprise a mixture of CO<sub>2</sub> and N<sub>2</sub>.
  4. A process according to claim 1, 2 or 3, characterized in that water and oxygen are recycled.
  5. A process according to claim 3 or 4, characterized in that a percentage of N<sub>2</sub> and CO<sub>2</sub> of 75 to 85 and 15 to 25%, respectively, is obtained, such that the sum of both results in 100%.
  6. A process according to any one of claims 1 to 5, characterized in that part of the air coming from the chimney is taken in order to augment the concentration of N<sub>2</sub> of the injection gases.
  7. A process according to any one of claims 1 to 6, characterized in that the emission gases of the combustion of materials selected from the group consisting of fossil fuel (oil, gas and coal) or alternative fuels as waste tires and waste wood, etc. and combinations thereof are used.
- Sub B6



7.DEZ.2000 16:36 AUPAT-DR.HAFFNER +43 1 5339250

NR.894 S.6

- 2 -

Sub C3  
8. A proces for reducing the contamination in the cement clinker production, characterized in that the effluences coming from combustion and/or calcining gases are subjected to one or more of adsorption, separation of dusts, condensation, liquefaction, distillation and compression and that temperature, concentration, pressure and/or expenditure of the effluences are adjusted in order to obtain treated inert gases compatible for utilizing them for recovering hydrocarbons in oil wells.

- 10 9. Use of industrial effluences for recovering hydrocarbons in oil wells characterized in that the industrial effluences are subjected to one or more of adsorption, separation of dusts, condensation, liquefaction, distillation and compression and that temperature, concentration, pressure and/or expenditure of the industrial effluences are adjusted in order to obtain treated inert gases compatible with the hydrocarbons of the deposit and that the treated inert gases are injected into the oil well.
- 15



add B7

add C3